

CONFIDENTIAL

48 " Receiving antenna

VS Government

(SUPPORTING MATERIAL -

PROGRESS REPORT FOR 00/01/58 - 00/01/61

RECEIVING DISH ANTENNA 600-6000 MC

00/01/61

ORIGINAL CL BY 235779
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EXT BYND 6 YRS BY SAME
REASON 3d3

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CONFIDENTIAL

Prodelin Inc. - Sectionalized Parabolic Reflectors

A. Five each, four foot circular spun aluminum dishes for packaging in containers 20" x 20" x 12" O. D.

B. Sets of R. F. feeds for each reflector covering 1000 to 6000 mcs.

C. Feed mounting for either horizontally or vertically polarized signal reception.

D. 50 ohm feeds not exceeding a V.S.W.R. of 3:1.

E. Gain commensurate to feeds and parabolas for this range with side lobes at least 10 db below the main lobe.

F. For installation in sheltered positions where wind and temperature can be neglected. Therefore, a simple tripod mount is requested with a vertical adjustment from four to eight feet for the top of the reflector.

G. 30 ft. of Semi-flexible aluminum transmission line should be provided with each reflector assembly. The necessary end fittings should be provided for each transmission line. The cable should be of minimum size for convenience of coiling and will be used for receiving applications only.

H. A simple azimuth indicator should be provided with each assembly. The azimuth indicator need not be furnished if it advances the date of delivery.

The detail costs, construction plans and characteristics are requested for equipment covering the 1000 - 6000 mcs range.

The delivery schedule is very important and must be firm. It was estimated that four (4) weeks would be required to deliver two reflectors and feeds.

PROGRESS REPORT
FOR
MONTH OF JANUARY 1961

*File 605
T.O. 4
CSR*

ELECTROMAGNETIC HORN ANTENNA

Purpose: To develop a system of antennas, filters and detectors for the 50 mc to 40,000 mc frequency range.

Personnel: Electrical Engineers:
Mechanical Engineer:

25X1

Status: The following information is progress made on another task order and is included here as progress made pursuant to completion of this task order. Final models of the 4000-8000 mc bandpass filter are under construction. Completion of the final models is anticipated early in the next period. Refinements in the design of the 2000-4000 mc bandpass filter are under way. A final model should be completed by the middle of the next period. The redesigned 10,000 mc to 40,000 mc horn antenna and waveguide detector assembly is under way. Preliminary testing should begin during the next period on the horn antenna systems.

Future Plans: Final testing will be accomplished on the 8,000-10,000 mc, 4000-8000 mc and 2000-4000 mc bandpass filters during the next period.

File 000/4

PROGRESS REPORT
FOR
MONTH OF OCTOBER 1959

RECEIVING DISH ANTENNA 600 - 6000 MC

Purpose: The scope of this project is to design, develop, and fabricate six 4 ft. dish antennas, five of which are the "breakdown" type and one is of the solid type plus the supporting tripods. Also, ten primary feeds are to be designed, developed and fabricated for these dishes.

Personnel: Electrical Engineer:
Mechanical Engineers:

25X1

Status: This EP has been closed out.

file 605/4

PROGRESS REPORT
FOR
MONTH OF SEPTEMBER 1959

RECEIVING DISH ANTENNA 600 - 6000 MC

Purpose: The scope of this project is to design, develop, and fabricate six 4 ft. dish antennas, five of which are the "breakdown" type and one is of the solid type plus the supporting tripods. Also, ten primary feeds are to be designed, developed and fabricated for these dishes.

Personnel: Electrical Engineer:

Mechanical Engineers:

25X1

Status: The final report has been finished and distributed. All residue belonging to the project has been turned in for processing.

Future Plans: The project will be closed next month.

file 603/7

PROGRESS REPORT
FOR
MONTH OF AUGUST 1959

RECEIVING DISH ANTENNA 600 - 6000 MC

Purpose: The scope of this project is to design, develop, and fabricate six 4 ft. dish antennas, five of which are the "breakdown" type and one is of the solid type plus the supporting tripods. Also, ten primary feeds are to be designed, developed and fabricated for these dishes.

Personnel: Electrical Engineer:
Mechanical Engineers:

25X1

Status: The four remaining antennas were shipped to the customer on 25 August 1959.

Five extra log periodic feeds were shipped on 1 August 1959.

A final report has been completed and is being printed at present.

Future Plans: The printing of the final report will be completed in approximately two weeks. This report will be distributed and the project closed during the month of September.

file 60011

PROGRESS REPORT
FOR
MONTH OF JULY 1959

RECEIVING DISH ANTENNA 600 - 6000 MC

Purpose: The scope of this project is to design, develop, and fabricate six 4 ft. dish antennas, five of which are the "breakdown" type and one is of the solid type plus the supporting tripods. Also ten primary feeds are to be designed, developed and fabricated for these dishes.

Personnel: Electrical Engineer:
Mechanical Engineers:

25X1

Status: Four of the remaining 9 feeds have been completed and tested. Five more are in the last stages of being foamed.

The status of the coax cable is same as was discussed in last month's report.

Future Plans: Four antenna systems and five extra feeds will be delivered. Three of these antenna systems will be delivered with RG 8/U coax cable; the air dielectric coax will be forwarded as soon as delivery has been made by Prodelin.

A final report will be written as previously mentioned.

File 605/4

PROGRESS REPORT
FOR
MONTH OF JUNE 1959

RECEIVING DISH ANTENNA 600 - 6000 MC

Purpose: The scope of this project is to design, develop, and fabricate six 4 ft. dish antennas, five of which are of the "breakdown" type and one is of the solid type plus the supporting tripods. Also ten primary feeds are to be designed, developed and fabricated for these dishes.

Persommel: Electrical Engineer:
Mechanical Engineers:

25X1

Status: The four remaining antennas on this project are completed except for the coax and the feeds. The feeds are being foamed at the present time. Enough coax is on hand for one antenna.

The instruction books have been completed and are in the process of being delivered.

Future Plans: Foaming the log periodic feeds is requiring more time than originally anticipated; the feeds should be completed, tested, and ready to be packed by 24 July 1959.

As mentioned in last month's report, the remainder of the air dielectric coax necessary to complete the antennas was to have been delivered by 1 July 1959; that delivery date has now been changed to 1 September 1959. Since the antennas will be ready to be packed by the last week in July, the revised delivery date of the coax will delay delivery of three of the

antennas. As a temporary expedient, the three antennas could be shipped with type RG 8/U coax which would be replaced with the air dielectric coax as soon as delivery was made by Prodelin.

605/7

PROGRESS REPORT
FOR
MONTH OF MAY 1959

RECEIVING DISH ANTENNA 600 - 6000 MC

Purpose: The scope of this project is to design, develop, and fabricate six 4 ft. dish antennas, five of which are of the "breakdown" type and one is of the solid type plus the supporting tripods. Also ten primary feeds are to be designed, developed and fabricated for these dishes.

Personnel: Electrical Engineer:
Mechanical Engineers:

25X1

Status: One antenna has been shipped to the customer. All necessary parts for the four remaining antennas are built and are being assembled at present. This includes the nine log periodic feeds. The four antennas and extra feeds will be ready to ship by the first week of July. The instruction book is nearing completion and will be sent out by the middle of June.

Future Plans: The feeds will be given spot electrical checks after completion. The four remaining antennas and five extra feeds will be packed for shipment as soon as they are completed. All of the Prodelin, Inc. semi-flexible coax has not been received. At present, enough coax is on hand for one antenna. The remainder of the coax has been promised by July 1, 1959. The actual delivery date of the remaining antennas will depend on the approval of the first antenna sent to the customer and the delivery of the above mentioned coax.

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PROGRESS REPORT
FOR
MONTH OF APRIL 1959

RECEIVING DISH ANTENNA 600 - 6000 MC

Purpose: The scope of this project is to design, develop and fabricate six 4 ft. dish antennas, five of which are of the "breakdown" type and one is of the solid type plus the supporting tripods. Also ten primary feeds are to be designed, developed and fabricated for these dishes.

Personnel: Electrical Engineer:
Mechanical Engineers:

25X1

Status: A final model of this antenna has been assembled and tested. A complete set of radiation patterns were taken; gain measurements were made; and the input VSWR of the feed in conjunction with the reflector was checked. A representative set of patterns as well as curves of VSWR and gain as a function of frequency will be presented in the instruction book and final Engineering Report. The erection procedure and reflector contour were also checked.

Because of poor high frequency performance, the Andrew air dielectric coax (Heliak) mentioned in previous reports will not be used; 3/8 inch Prodelin Inc. semi-flexible coax will be furnished with this antenna instead.

Future Plans: The first antenna will be shipped about May 11. The four remaining antennas can be shipped as soon as the log periodic feeds are finished. At present, the nine remaining feeds are being fabricated. The delivery date in part is dependent on customer approval of the first antenna. The instruction book is being written and should be finished by June 1.

PROGRESS REPORT
FOR
MONTH OF FEBRUARY 1959

RECEIVING DISH ANTENNA 600 - 6000 MC

Purpose: The scope of this project is to design, develop, and fabricate six 4 ft. dish antennas, five of which are of the "breakdown" type and one is of the solid type plus the supporting tripods. Also, ten primary feeds are to be designed, developed and fabricated for these dishes.

Personnel: Electrical Engineers:

Mechanical Engineer:

Status: The impedance match of the test model periodic feed was improved to a VSWR of less than 3:1 over the entire band except at two sharp points where the VSWR was 3.1:1. This was accomplished by varying the impedance transformation of the tapered line balun. The above VSWR was measured with the feed in front of a four foot dish. A final model of the periodic feed is being fabricated and will be completed the first week of March.

The design of the feed support, dish supports, and the quadripode has been completed. A complete Engineering model of the dish and supporting quadripode has been assembled. The feed support is nearing completion in the model shop. The coax cable has not been received from Andrew yet (it is a month overdue).

Future Plans: The VSWR of the final model feed will be checked with and without the dish. The VSWR of the feed quoted might increase slightly

25X1

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because of being foamed. If this increase is too great, it may be necessary to make slight modification in the tapered line balun. Patterns of both the feed alone and the dish will be taken and the gain of the dish measured. The instruction book will be written about the last of March.

PROGRESS REPORT
FOR
MONTH OF MARCH 1959

RECEIVING DISH ANTENNA 600 - 6000 MC

Purpose: The scope of this project is to design, develop, and fabricate six 4 ft. dish antennas, five of which are of the "breakdown" type and one is of the solid type plus the supporting tripods. Also, ten primary feeds are to be designed, developed and fabricated for these dishes.

Personnel: Electrical Engineers:

Mechanical Engineers:

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25X1

Status: The free space input VSWR of a final model of the log periodic feed was measured to be under 2.7:1 over its prescribed frequency band. The VSWR of the same feed when placed in front of its reflector was under 3.2:1 over the entire band and was under 3:1 over 95% of the band.

Patterns of the dish were taken, and it was found that the metal quadripode legs supporting the feed resulted in high side lobes at the low end of the band. The final quadripode legs will be of dielectric material. Patterns were also taken on the primary feed in free space.

Two lengths of cable mentioned in last month's report have been received and the remainder of the order promised by 15 April 1959.

The instruction book has been started.

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Future Plans: The patterns of the dish with the final feed supporting quadripode will be taken. The gain of the dish will be measured at several points in the band. The antenna will then be ready to be delivered to the customer.

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PROGRESS REPORT
FOR
MONTH OF JANUARY 1959

RECEIVING DISH ANTENNA 600 - 6000 MC

Purpose: The scope of this project is to design, develop, and fabricate six 4 ft. dish antennas, five of which are of the "breakdown" type and one is of the solid type plus the supporting tripods. Also, ten primary feeds are to be designed, developed and fabricated for these dishes.

Personnel: Electrical Engineers:
Mechanical Engineer:

25X1

Status: The E-plane and H-plane patterns of the 4 foot dish were taken as mentioned in last month's report. The side lobe level was a maximum of 12 db down at 600 mc. In general, the pattern characteristics of the dish were very good. The impedance of the logarithmically periodic primary feed was measured in conjunction with the dish. A test model of a tapered line balun was constructed for the primary feed and the input VSWR checked. It was found that the VSWR was below 4:1. Patterns were also taken on the primary feed alone to determine if this balun had any effect on the pattern characteristics of the feed; very minor effects were observed.

The engineering model of the supporting quadripode and sectional vertical support has been built. The quadripode has been assembled; the vertical support will be assembled as soon

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as delivery of cable used to hold the sections together has been made. All of the sectional dishes have been delivered and the parts to hold the sections together have been built for two dishes to date.

Future Plans: Further work will be done to see if the periodic feed match can be improved. A foamed model of the feed with its balun will be built and final patterns will be taken on the completed antenna. The instruction book will be written.

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RECEIVING DISH ANTENNA 600 - 6000 MC

Purpose: The scope of this project is to design, develop, and fabricate six 4 ft. dish antennas, five of which are of the "breakdown" type and one is of the solid type plus the supporting tripods. Also, ten primary feeds are to be designed, developed and fabricated for these dishes.

Personnel: Electrical Engineer:
Mechanical Engineer:

25X1

Status: With reference to last month's report a logarithmically periodic structure having the following design parameters was constructed:
 $\alpha = 60^\circ$, $\gamma = .707$, $\beta = 10^\circ$, $\psi = 45^\circ$ and with the length of the last element being 26 cm. long.

The impedance was measured and patterns were taken on this structure under free space conditions.

The structure was then placed in front of a four foot dish and data was taken for curves of relative gain versus the spacing between the structure and the surface of the dish as outlined in a previous report. From these curves a compromise location of the feed was found and at the present time patterns are being taken of the dish antenna to confirm that the choice of location of the feed with respect to the dish was a good one as far as side lobes are concerned.

During the above measurements, the absolute gain of the dish was measured at 6000 and 950 mc. It was found that the gain at 6000 mc was about 34.5 db and at 950 mc the gain was about 19.3 db. These gain figures are in very good agreement with theoretical values.

The design of the engineering model of the supporting quadripode and sectional vertical support has been completed and is being built in the model shop. It will be assembled sometime next month. Two sectional dishes have been received and one is in the process of being assembled.

Future Plans: The impedance of the logarithmically periodic feed will be measured in conjunction with the dish and necessary steps taken to match the impedance of the feed to a fifty ohm line as required.

The final support for the feed will be designed and electrical and mechanical checks will be made on the sectional dishes to confirm their conformity to the solid dish now being tested.

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RECEIVING DISH ANTENNA 600 - 6000 MC

Purpose: The scope of this project is to design, develop, and fabricate six 4 ft. dish antennas, five of which are of the "breakdown" type and one is of the solid type plus the supporting tripods. Also, ten primary feeds are to be designed, developed and fabricated for these dishes.

Personnel: Electrical Engineer:

25X1

Mechanical Engineer:

Status: All previous measurements have been made using models with an α angle of 75° . In order to determine whether or not this was the best α angle to use, sheet, trapezoidal tooth structures having α angles of 90° , 82.5° , 75° , 67.5° , 60° , 52.5° , and 45° were constructed and tested as to location of phase center, E and H plane patterns, and impedance and VSWR over a half period. From this data it appears that a structure having an α angle of 60° was the most desirable. As stated in last month's report the sheet type structures have better characteristics as to the stability of the location of the phase center over a period of frequencies.

From the above observations and other considerations (such as front-to-back ratio and E and H plane beamwidths) the structure to be used for the primary feed will be of the sheet, trapezoidal tooth type with the following parameters: $\alpha = 60^\circ$, $\tau = .707$, $\beta = 10^\circ$ and $\psi = 45^\circ$.

The test set up for measuring the relative gain of the complete antenna (primary feed and reflector) as a function of the deviation of the phase center of the primary feed from the focal point of

the reflector as mentioned in last month's report is nearing completion and should be functioning within a week.

The design of the tripod is pretty well completed. Sectional dishes which have been on order have not been received as yet.

Future Plans: The relative gain measurements as described in last month's report will be made as soon as possible, as well as the measurement of the impedance of the feed in conjunction with the dish.

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RECEIVING DISH ANTENNA 600 - 6000 MC

Purpose: The scope of this project is to design, develop, and fabricate six 4 ft. dish antennas, five of which are of the "breakdown" type and one is of the solid type plus the supporting tripods. Also, ten primary feeds are to be designed, developed and fabricated for these dishes.

Personnel: Electrical Engineer: 25X1
Mechanical Engineer:

Status: A wire type logarithmically periodic structure having the same design parameters as the printed sheet structure mentioned in last month's report was constructed. Patterns taken on this structure over the frequency range of 600 to 6000 mc were very similar to those of the printed sheet structure even at the high end of the band where the construction tolerances are very difficult to maintain.

The location of the phase center of this wire structure was determined over a half period for ψ angles from 15° to 90° in 15° steps. It was found that the distance from the phase center to the apex of the structure varied considerably over a half period especially for the high ψ angles (above 60°). From the limited data taken so far, it appears that the location of the phase center over a half period is more stable for the sheet type structures.

The requested solid 4 foot dish has been shipped. The 5 sectional dishes have been ordered. The mounting structure for the solid dish except for the tripod has been designed

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and is now being built in the Model Shop. An experimental primary feed mount has been designed and is being constructed.

Future Plans: Utilizing the above mentioned experimental primary feed mount, which permits the distance of the primary feed from reflecting surface to be varied along the axis of the dish, various feeds of both the wire and solid types will be mounted in front of the reflector. The relative gain versus the spacing of the feed from the reflector will be plotted for several logarithmically related frequency over the 600 to 6000 mc band. From this data a compromise location for the primary feed can be found. Also, the characteristic impedance of the various feeds will be measured.

RECEIVING DISH ANTENNA 600 - 6000 MC

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Purpose: The scope of this project is to design, develop, and fabricate six 4 ft. dish antennas, five of which are of the "breakdown" type and one is of the solid type plus the supporting tripods. Also, ten primary feeds are to be designed, developed and fabricated for these dishes.

Personnel: Electrical Engineer:

Mechanical Engineer:



25X1

Status: The phase center of the logarithmically periodic primary feed antenna mentioned in last month's report was located as a function of ψ angle in 15 degree steps from 15 to 120 degrees. It was found that the phase center coincided with the apex of the structure at a ψ angle of about 120 degrees. This is unfortunate because the front to back ratio of a structure with a ψ angle of 120 degrees is very poor; such a structure could not be used as a primary feed. Therefore, it will be necessary to investigate the effect on the pattern characteristics of the dish as a function of a deviation of phase center of the primary feed from the focal point of the dish. Two four foot spun aluminum dishes were ordered and have been received.

Future Plans: A study will be made of the literature to determine what has been learned in previous investigations as to the effect on the patterns characteristic of a parabolic reflector when the phase center of the primary feed does not coincide with the focal point of the reflector. A setup for recording the patterns of a dish with its primary feed will be made. Work will be done on the design of the supporting tripods required and the sectional dishes.

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Aug 58

RECEIVING DISH ANTENNA 600 - 6000 MC

Purpose: The scope of this project is to design, develop, and fabricate six 4 ft. dish antennas, five of which are of the "breakdown" type and one is of the solid type plus the supporting tripods. Also, ten primary feeds are to be designed, developed and fabricated for these dishes.

Personnel: Electrical Engineer: Mechanical Engineer:

Status: During the last month a model of a logarithmically periodic primary feed antenna was constructed and patterns were taken over the frequency range of 350 to 6500 mc. This includes the 600 to 6000 mc range necessary for this particular project. The average E-plane beam-width at the 3 db points was about 65° and at the 10 db points was about 110° . In order to illuminate the reflector with a 10 db taper the focal length to diameter ratio of the dish should be about .5.

With this f/d ratio in mind, several dish manufacturers have been contacted. Two of these manufacturers are tooled up to spin 4 foot dishes with focal lengths of about 2 feet.

The equipment for measuring the phase center of the primary feed is set up.

25X1

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Future Plans: The phase center of the primary feed will be located for various ψ angles (ψ is the angle between the two half structures). This is the parameter which appears to have the greatest amount of control in varying the distance of the phase center from the apex of the structure. As explained in last month's report, the ideal condition is to locate the phase center at the apex of the structure.

Two 4 foot dishes will be ordered in the near future, one will be sent to the Government, the other will be retained for test purposes.

Work will be begun on the design of the supporting tripod this month.

-4-

July 58

BROADBAND DISH ANTENNAS

Purpose: The scope of the project provides for the design, development, and fabrication of six, four-foot aluminum dish antennas plus supporting tripodes. Five of the dishes are to be of the "breakdown" type; one dish is to be of the solid type. In addition, the project provides for the design, development, and fabrication of ten feeds for the dishes.

Personnel: Electrical Engineer:
Mechanical Engineer:

25X1

Status: A good technique has been established for measuring the phase center of logarithmically periodic structures. Preliminary results indicate that the ratio of the distance from the apex of the logarithmically periodic structure d to the wavelength λ is relatively constant ($d/\lambda \approx \text{constant}$) and that the distance from the apex to the phase center can be controlled to a limited extent by varying the parameters of the structure. If it is possible to locate the phase center at the apex of the structure, a dish feed can be designed to have a bandwidth as wide as that of the basic logarithmically periodic structure.

Future Plans: During the next month work will begin on the dish design, and additional work will be done on controlling the position of the phase center of the logarithmically periodic structure.











